B.E DEGREE EXAMINATION – NOV / DEC -2012

B.E - MECHATRONICS ENGINEERING

MCT 154 - MICRO ELECTRO MECHANICAL SYSTEMS

Answer all questions

PART – A **(1 X 10 = 10)**

1. MEMS Components range in size from _____
   a) 1µm to 1mm b) 1nm to 1µm c) 1 mm to 1 cm d) 0.5 µm to 1 mm

2. Scaling laws are derived from ____
   a) Design engineers' experience b) the law of physics c) overall dimension of the MEMS product d) the economic effect

3. As the gap between the electrodes grows smaller , the electrostatic forces for actuation _____
   a) Grow stronger b) grow weaker c) do not change d) remains same

4. Micro accelerometers are used to measure _____
   a) the velocity b) the position c) the dynamic forces associated with a rigid body moving at variable speed d) tensional force

5. A mathematical model of the diffusion process is based on _____
   a) Fourier's law b) Newton's law C) Fick's law d) faraday's law

6. The toughest plane for processing in a single silicon crystal is _____
   a) the (100) plane b) the (111) plane c) the (110) plane d) the (101) plane

7. The principle of micro fabrication process used in bulk manufacturing is _____
   a) etching b) deposition c) diffusion d) vaporization

8. Packaging technologies for microelectronics and Microsystems are _____
   a) the same b) different c) interchangeable d) very significant

9. In general , the cheapest way to produce MEMS is _____
   a) Bulk micro-manufacturing b) surface manufacturing c) the LIGA process d) none of the above

10. The very first significant miniaturization occurred with _____
    a) Integrated circuits b) laptop computers c) mobile telephones c) calculators

Answer all questions

PART – B **(10 X2=20)**

11. Define MEMS.
12. What is the purpose of scaling law?
13. Classify the micro actuation techniques.

14. What is the working principle of micro gripper?
15. Differentiate active substrate and passive substrate.
16. What is mean by etching?
17. Distinguish between surface micro manufacturing and bulk micro manufacturing.
18. State the general considerations in packaging design.
19. State any five principal substrate materials.
20. Write any four MEMS applications related to telecommunication field.

PART- C **(5 X14=70)**

21. a) What is the importance of scaling in micro system? Explain in detail about scaling in geometry.

(OR)

21. b) Derive the equation of scaling in fluid mechanics. What will happen to the volumetric flow and pressure drop in a circular tube by reducing the radius of it?

22. a) What is meant by micro sensor? Explain about Bio-medical sensor and Bio-sensor in detail.

(OR)

22. b) Explain about the types, construction details and working principle of micro accelerometers.

23. a) Explain in detail about the general procedure of photolithography process.

(OR)

23. b) Write short notes on the following micro fabrication process

(i)Oxydation (5)

(ii)Diffusion (5)

(iii)CVD (4)

24. a) Explain about the LIGA process with neat diagram.

(OR)

24. b) Write notes on the following micro system packaging techniques

i) Anodic Bonding (7)

ii) Wedge-wedge ultrasonic bonding (7)

25. a) List and explain about the various design constraints in micro product development.

(OR)

25. b) Describe in detail about application of micro system in automotive field.

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